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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): C.I. Podilchuk et al.
Case: 11-1
Serial No.: 09/368,380
Filing Date: August 4, 1999
Group: 2613
Examiner: Charles E. Parsons

Title: Method and Apparatus for Dense Motion Field Based Coding

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TRANSMITTAL OF REPLY BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith are the following documents relating to the above-identified patent application:

(1) Reply Brief in triplicate (original and two copies).

It is believed that there is no additional fee due in conjunction with the response. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Ryan, Mason & Lewis, LLP Deposit Account No. 50-0762** as required to correct the error. Duplicate copies of the Reply Brief are enclosed.

Respectfully submitted,

Joseph B. Ryan

Date: June 23, 2003

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I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature: Susan M. Hanlin Date: June 23, 2003

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REPLY BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Reply Brief is submitted in response to the Examiner's Answer dated April 22, 2003 in the above-referenced application.

ARGUMENT

The Examiner in his Answer to the Appeal Brief filed by Applicants on February 27, 2003, has withdrawn the 35 U.S.C. §103(a) rejection of dependent claims 7 and 17, indicating for the first time that these claims contain allowable subject matter. However, the Examiner has reasserted the argument that each of claims 1-6, 8, 11-16, 18 and 21-26 is unpatentable under 35 U.S.C. §102(b), §102(e) or §103(a). Applicants respectfully disagree with the assertions presented by the Examiner in the Answer, for the reasons identified below, as well as for the reasons previously set forth in the Appeal Brief.

Regarding independent claims 1 and 11, which stand rejected under §102(b) by U.S. Patent No. 5,654,771 (hereinafter "Tekalp"), these claims call for a particular type of motion estimation based on a dense motion field of a portion of the image sequence. More specifically, each of these claims specifies that the estimate is generated at least in part as a constrained function of a characterization of motion between elements of the dense motion field and elements of one or more other portions of the image sequence. The Examiner in the Answer argues that Tekalp meets this limitation because "Tekalp constrains the areas containing these vectors by grouping them together into separate sections" such that "each section or element of the dense motion field is characterized by the motion vectors constrained to that particular area" (Answer, page 8, section 11, second paragraph). However, even if one were to assume for purposes of argument that the proffered characterization of Tekalp is correct, it does not meet the claim limitation in question. As indicated above, the claimed "constrained function" is a constrained function of a characterization of motion between elements of the dense motion field and elements of one or more other portions of the image sequence.

Applicants respectfully submit that the claimed "constrained function" is not synonymous with a defined area of an image, such as "an area marked off by a polygon," because the mathematical function defining the area is not a constrained function of a characterization of motion between elements of the dense motion field and elements of one or more other portions of the image sequence. More specifically, if the "area marked off by a polygon" as referenced by the Examiner is viewed as representing a constrained mathematical function, such a function is not a constrained function of a characterization of motion, but is instead simply a function of the corresponding defined image area.

Applicants also note that the use of the particular constrained function as claimed provides advantages that are not provided by the area-based image segmentation approach of Tekalp. For example, the claimed constrained function of a characterization of motion can be used to smooth a dense motion field, such that the motion field can be encoded very efficiently. Without use of such a constrained function, the amount of side information required to encode the motion vectors becomes impractically large, as is described in the present specification at, for example, page 5, lines 5-18.

Applicants therefore respectfully submit that independent claims 1 and 11 are not anticipated by Tekalp.

Regarding independent claims 21 and 24, which stand rejected under §102(e) as being anticipated by U.S. Patent No. 6,226,410 (hereinafter "O'Rourke"), each of these claims calls for generation of an estimate of apparent motion within an image sequence, "wherein the estimate is generated at least in part utilizing a Markov random field (MRF) model to characterize motion between a given pixel of a motion field and one or more neighbor pixels." The Examiner in support of the anticipation argument relies on a reference to Huber Markov random field (HMRF) in column 4, line 67 to column 5, line 36 of O'Rourke. However, as Applicants indicated in their Appeal Brief, this teaching clearly relates to decoding of a previously-encoded image sequence, and not to encoding of the image sequence as claimed. In the Answer, at page 8, section 11, final paragraph, the Examiner further states that the HMRF reference in the context of decoding in O'Rourke is properly viewed as anticipatory of the claim limitation relating to utilization of an MRF model in generation of a motion estimate because:

> [E]very decoder must be an exact reversal of an encoder otherwise the data will not be decoded properly. As a result if a Markov model is used to encode, it must be used to decode.

Applicants respectfully submit that the Examiner is incorrect on this point. There are many examples of decoders that utilize estimation techniques that are not part of the corresponding encoders. This is due to the fact that decoders typically must estimate data in the presence of noise, transmission errors, lost information and the like, while such degradations are not an issue in the corresponding encoders because the data being encoded is fully known. Viterbi decoding and maximum likelihood estimation (MLE) are examples of decoder estimation techniques that are not needed or utilized in the corresponding encoders. The O'Rourke maximum a posteriori (MAP) estimation technique based on an HMRF image model is another example. Applicants therefore disagree with the argument put forth by the Examiner to the effect that use of HMRF in a decoding

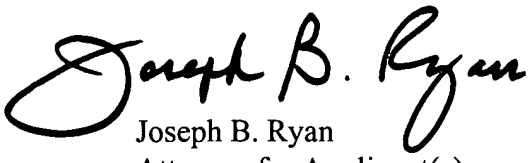
process in O'Rourke necessarily teaches the claimed utilization of an MRF model in generating a motion estimate in an encoding process.

Applicants also note that the portion of the O'Rourke reference in column 5, lines 20-55 relied upon by the Examiner in the Answer describes the use of an HMRF image model in a MAP decoding process, and not an encoding process as alleged by the Examiner. More specifically, this portion of O'Rourke refers to an estimated image $\hat{z}$ generated by decompressing a previously-compressed image, and thus relates to decoding rather than encoding in the context of independent claims 21 and 24. See O'Rourke at column 4, line 54 to column 5, line 36. Moreover, O'Rourke, although it utilizes MAP estimation based on an HMRF image model in decoding, specifically teaches away from the limitation in question by disclosing the use of conventional block-based motion estimation in encoding. This is readily apparent from FIG. 7 of O'Rourke and the associated text at column 10, lines 7-62.

Applicants therefore respectfully submit that O'Rourke teaches encoding based on conventional block-based motion estimation, and fails to teach or suggest the claimed generation of an estimate of apparent motion within an image sequence, "wherein the estimate is generated at least in part utilizing a Markov random field (MRF) model to characterize motion between a given pixel of a motion field and one or more neighbor pixels." It is thus believed that independent claims 21 and 24 are not anticipated by O'Rourke.

For the reasons identified above and in the previously-filed Appeal Brief, Applicants respectfully submit that the §102(b), §102(e) and §103(a) rejections are improper and should be withdrawn.

Respectfully submitted,



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